ARCADIS Design & Consultancy for natural and built assets

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ENVIRONMENT

Subject:
Work Plan for Collection of Soil Samples for
Soil Washing Treatability Study and Additional Delineation of PCBs,
Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.

Date:
October 28, 2016

Contact:
David Stern

Phone:
631-391-5284

Email:
David.stern@arcadis.com

Our ref:
NY001496.2315

Dear Steve:

Arcadis of New York, Inc. (Arcadis) has prepared this Work Plan as requested by Northrop Grumman Systems Corporation (Northrop Grumman) to support the remedy to meet the remedial action objectives (RAOs) included in the Record of Decision (ROD) for Operable Unit 3 (OU3) issued by the New York State Department of Conservation (NYSDEC). This Work Plan consists of the following elements:

- Collection of soil samples for performance of a treatability study as part of further evaluation of the soil washing remedial approach; and
- Collection of soil samples for delineation of polychlorinated biphenyls (PCBs) in soil to refine the estimated volumes of PCB-impacted soil.

Most of the work will be performed in the ballfield area of the Bethpage Community Park, in Bethpage, New York (Site). The data obtained from implementation of this Work Plan will supplement the findings of the NYSDEC-approved Pre-Design Sampling and Remedial Alternative Evaluation Report for PCBs and Metals in Soil (Arcadis 2015) (Pre-Design Report). The scope of work and schedule for the delineation and treatability study activities are provided below.

Arcadis will adhere to the provisions of the existing access agreement between Northrop Grumman and the Town of Oyster Bay (Town) for field activities performed at the Site and will coordinate with the Town during the planning and performance of the work.

SAMPLING PLAN FOR SOIL WASHING TREATABILITY STUDY

To further evaluate soil washing, soil samples will be collected and analyzed as part of a treatability study. The results of the treatability study will determine the maximum concentrations of PCBs and metals that can be successfully soil washed to meet RAOs.

To develop the sampling plan, existing data were reviewed to determine the range of soil concentrations for PCBs and metals. Based on this review, samples with the following target concentrations will be collected in the field for the treatability study:

- **PCBs:** 100 milligrams per kilogram (mg/kg) to 1,000 mg/kg, at 100 mg/kg increments.
- **Cadmium:** 10 mg/kg, 100 mg/kg, and 1,000 mg/kg.
- **Chromium:** 500 mg/kg, 2,000 mg/kg, 5,000 mg/kg, and 50,000 mg/kg.
- **Arsenic:** Since the maximum observed concentration is only twice the RAO, arsenic is not expected to affect the outcome of the treatability study; therefore, soil sampling specifically targeting arsenic is not proposed.

A total of 13 previous boring locations ("primary locations") were selected for treatability study sample collection. These 13 primary locations were selected because samples from those locations previously exhibited PCBs and/or metals in the concentration ranges listed above. Three soil borings will be advanced in a triangular pattern around each of these 13 primary locations (total of 39 soil borings) to collect the required volume of soil for the treatability study. For each of the 13 primary locations, a contingency location is identified for sampling in case soil samples with target concentrations are not acquired at the primary location. **Table 1** lists the primary and contingency sampling locations, targeted sampling intervals, and the target PCB and metals concentrations. **Figure 1** depicts the locations of the primary and contingency soil borings. Minor changes in sampling locations and depths may be made to respond to field conditions.

Samples will be shipped to two independent firms equipped with treatability testing labs (testing labs) (Kemron Environmental Services, Inc. and ART Engineering, LLC) for soil treatability testing. Each laboratory will receive an aliquot equivalent to five gallons of soil (approximately 60 pounds, dry weight) from each sample. An additional 60 pounds of soil will be retained from each location and temporarily stored at Northrop Grumman's McKay Field staging area in case additional analysis is needed.

Prior to sampling, locations will be staked out using global positioning system (GPS) technology. Subsurface utilities will be marked out using a minimum of three lines of evidence (e.g., One-Call, soft dig, ground-penetrating radar), in accordance with the site-specific health and safety plan (HASP).

The sequence for sampling, logging, and preparing the soil samples for treatability laboratory analysis at a given location is as follows:

1. Three boreholes will be drilled with a track-mounted Mini-Sonic Rig in a triangular pattern proximal to the staked-out location. The drill rig will advance an 8-inch inner diameter casing to obtain the required soil volume from the targeted depth interval (**Table 1**). The sample from the targeted interval will be retrieved from the sonic rig soil core, lithologically logged, and photographed.
2. A 4.7-millimeter mesh screen will be used to remove the oversize fraction (e.g., fill, pebbles, cobbles) from the retrieved sample. Representative samples of any unusual materials (e.g., nodules) in the oversize fraction will be collected and analyzed for VOCs,

SVOCs, RCRA metals, and PCBs, with a standard 2-week turnaround time. Based on the totals results, TCLP will be performed, as appropriate.

3. Samples passing the 4.7-mm screen will first be field screened for total PCBs using a field test kit (e.g., EPA Method 4020) for the presence of total PCBs greater or less than 50 mg/kg. Soil samples passing the PCB screening (i.e., greater than 50 mg/kg total PCBs) will be couriered to a certified analytical laboratory for total PCB analysis using USEPA Method 8082 and metals using USEPA Method 6010. The results will be obtained within 24 hours.
4. After laboratory analysis confirms that the concentrations in the three samples from the targeted depth interval are consistent with the target concentrations, the samples will be homogenized in the field, creating a single composite sample representing the desired volume exhibiting the target concentrations.
5. The composite sample will be separate into three aliquots. Two will be shipped to the two testing labs, with the third retained for possible additional analysis. Samples will be shipped in compliance with Department of Transportation requirements.

SAMPLING PLAN FOR ADDITIONAL PCB DELINEATION

Soil sampling will be conducted to refine the delineation of PCBs corresponding to the NYSDEC-approved RAOs and other PCB concentrations, as summarized in the table below.

Depth of Impact (ft bls)	Target Concentration for Delineation (mg/kg)
Original grade to 2	1
2 – 10	10
Deeper than 10	50
All depths	500

A total of 71 soil borings will be advanced to different depths, including 52 borings in the ballfield, five borings in the playground area, and 14 borings in the Northrop Grumman Plant 24 Access Road/McKay Field Access Road. This work includes returning to previous borings and collecting samples from deeper intervals and/or stepping out laterally from the boring location. **Table 2** provides the soil sampling details and **Figures 2** and **3** show the proposed and previous boring locations, respectively.

Prior to sampling, subsurface utilities will be marked out and boring locations field verified by following the same methods used for the treatability study sample collection program. The thickness of the cover material placed on the ballfield by the Town will be verified where needed and sample depths adjusted to correct to the original grade.

Soil samples will be collected using an all-terrain Geoprobe direct-push drilling rig at the depth intervals listed in **Table 2**. The samples will be obtained in 5-ft long macro-cores, which will be lithologically logged and photographed. One or two provisional samples will be collected beyond

the depths indicated in **Table 2** and may also be analyzed, as necessary to meet the sampling objective. Soil samples from the bottom interval in each boring will be field screened for total PCBs using a field test kit (e.g., EPA Method 4020) for the presence of total PCBs greater or less than 50 mg/kg. Soil samples will be delivered via courier to a certified analytical laboratory for total PCB analysis using USEPA Method 8082. The results will be obtained within 24 hours. Depending on the results obtained from the laboratory analysis, additional borings may be advanced to meet the objective of the delineation effort. The laboratory data will be validated using the methods consistent with the Pre-Design Report.

FIELD PROGRAM LOGISTICS

For the two field programs described above, each drilling rig will be overseen continuously by an Arcadis field geologist. Sample collection, coordination with the analytical laboratory and sample shipment, and sample logging will be conducted by Arcadis personnel. Samples will be shipped to the treatability testing labs in sealed coolers and in compliance with Department of Transportation shipping regulations. Traffic in the ballfield during work activities will be managed by a traffic control technician.

Investigation derived waste (IDW) management, equipment decontamination methods, and site control will be generally consistent with the pre-design investigation conducted at the Site. Any IDW (e.g., drill cuttings) generated from soils exceeding 50 mg/kg PCBs, determined either through current lab analysis or previous sampling results (i.e., “as found” concentrations), will be segregated and handled as a TSCA-regulated waste. Any IDW that is determined to exceed TCLP will be segregated and disposed of as a RCRA characteristically hazardous waste.

ESTIMATED SCHEDULE

Northrop Grumman has coordinated with the Town of Oyster Bay to commence sampling during the week of October 31, 2016. The two components of this Work Plan will be completed simultaneously and is anticipated to require three weeks to complete. Work will be performed Monday to Friday (excluding Town holidays) from 8 a.m. to 5 p.m.

Please contact us if you need additional information.

Sincerely,

Arcadis of New York, Inc.

Carlo San Giovanni
Project Manager

Enclosures

Copies:
Ed Hannon, Northrop Grumman
Steve Karpinski, NYSDOH
Joe Defranco, NCDOH
Jim Haklar, USEPA
Peter Mannino, USEPA
David Stern, Arcadis
Mike Wolfert, Arcadis
Carol Henry Emery, EMAGIN

Table 1
Proposed Treatability Study Sample Details,
Operable Unit 3 (Former Grumman Settling Ponds),
Northrop Grumman Systems Corporation
Bethpage, New York.

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Boring ID	Proposed Sampling Interval (ft bls)	Target PCB Concentration (mg/kg)	Target Cd/Cr Concentration (mg/kg)
PCB Treatability			
I-11-14	4-6	1000	NA
G-12-14	4-6	1000	NA
H-9-14	**6-8**	**900**	**NA**
B-32	**10-12**	**900**	**NA**
I-10-14	**14-16**	**800**	**NA**
P-31	4-6	800	NA
F-16-14	10-12	700	NA
I-10-14	**16-18**	**700**	**NA**
J-10-14	8-10	600	NA
P-10-14	14-16	600	NA
L-20-14	6-8	500	NA
I-9-14	6-8	500	NA
I-18-14	6-8	400	NA
K-16-14	4-6	400	NA
I-6-14	**6-8**	**300**	**NA**
L-18-14	4-6	300	NA
H-9-14	**8-10**	**200**	**NA**
B-32	**7-9**	**200**	**NA**
nH-6-15	**2-4**	**100**	**NA**
J-12-14	6-8	100	NA
Metals Treatability			
J-5-14	**6-8**	**NA**	**1000 / 50000**
J-5-14	**8-10**	**NA**	**1000 / 50000**
nH-6-15	**6-8**	**NA**	**NA / 5000**
C-4-14	6-8	NA	NA / 5000
nR-23-14	0-2	NA	NA / 2000
nP-6-15	6-8	NA	NA / 2000
I-6-14	**4-6**	**NA**	**NA / 500**
K-9-14	8-10	NA	NA / 500
M-8-14	4-6	NA	100 / NA
K-5-14	4-6	NA	100 / NA
K-11-14	4-6	NA	10 / NA
F-11-14	6-8	NA	10 / NA

Notes:

Primary soil boring location ID used for treatability study. At each primary location, three borings will be drilled in a triangular pattern around the primary location to obtain the volume of soil needed at the target concentration for the treatability studies. Samples will be submitted to ART Engineering and Kemron Environmental Services, Inc., with one aliquot retained as contingency.

Contingency soil boring location ID. These borings will be drilled in the same manner as the Primary borings, if additional sample volume is needed to meet the target concentration.

nH-6-15 Denotes soil boring utilized for PCB and metal treatbility studies or to meet multiple target concentrations.

NA Not Analyzed
mg/kg milligrams per kilogram
ft bls feet below land surface

Table 2
Proposed Soil PCB Delineation Sample Details,
Operable Unit 3 (Former Grumman Settling Ponds),
Northrop Grumman Systems Corporation
Bethpage, New York.

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0-2 foot Horizon to Define 1 mg/kg	
Boring Location	Sample depth interval (ft bls)
Q-19	0-2
O-21	0-2
AJ-26	0-2
B-11	0-2
R-21	0-2
D-2	0-2
I-2	0-2
C-11	0-2
H-14	0-2
J-14	0-2
L-12	0-2
S-10	0-2
Q-13	0-2
C-17	0-2
B-19	0-2
ZZA-17	0-2
I-16	0-2
M-17	0-2
K-19	0-2
J-24	0-2
L-24	0-2
P-26	0-2
R-26	0-2
U-24	0-2
Y-24	0-2
E-26	0-2
E-27	0-2

2-10 foot Horizon to Define 10 mg/kg	
Boring Location	Sample depth intervals (ft bls)
G-5	2-4, 4-6
H-5	2-4, 4-6, 6-8, 8-10
I-5	2-4, 4-6, 6-8, 8-10
B-11	2-4, 4-6, 6-8, 8-10
O-21	2-4, 4-6
Q-19	2-4, 4-6, 6-8, 8-10
AI-24	2-4, 4-6, 6-8, 8-10
X-18	2-4, 4-6, 6-8, 8-10
U-20	2-4, 4-6, 6-8, 8-10
R-22	2-4, 4-6, 6-8, 8-10
O-13	2-4, 4-6, 6-8, 8-10
O-14	2-4, 4-6, 6-8, 8-10
Q-16	2-4, 4-6, 6-8, 8-10
D-2	2-4, 4-6, 6-8, 8-10
H-4	2-4, 4-6, 6-8, 8-10
nAB-25-14	2-4, 4-6, 6-8, 8-10
nAI-23-14	2-4, 4-6, 6-8, 8-10
nAG-19-14	2-4, 4-6, 6-8, 8-10
ZZA-23	2-4, 4-6, 6-8, 8-10

10-15 foot Horizon to Define 50 mg/kg	
Boring Location	Sample depth intervals (ft bls)
E-21	10-12, 12-14, 14-16
H-21	10-12, 12-14, 14-16
G-22	10-12, 12-14, 14-16
J-14	10-12, 12-14, 14-16
I-16	10-12, 12-14, 14-16
H-17	10-12, 12-14, 14-16
K-10	10-12, 12-14, 14-16
J-9	10-12, 12-14, 14-16
H-9	10-12, 12-14, 14-16
E-9	10-12, 12-14, 14-16
L-21	10-12, 12-14, 14-16
D-16	10-12, 12-14, 14-16
Q-19	10-12, 12-14, 14-16
B-11	10-12, 14-16
E-3	10-12, 12-14, 14-16
ZZA-13	10-12, 12-14, 14-16
O-12	10-12, 12-14, 14-16
L-12	10-12, 12-14, 14-16
K-20	10-12, 12-14, 14-16
N-20	10-12, 12-14, 14-16
nAH-23-14	10-12, 12-14, 14-16

Notes:

mg/kg	milligrams per kilogram
ft bls	feet below land surface

Table 2
Proposed Soil PCB Delineation Sample Details,
Operable Unit 3 (Former Grumman Settling Ponds),
Northrop Grumman Systems Corporation
Bethpage, New York.

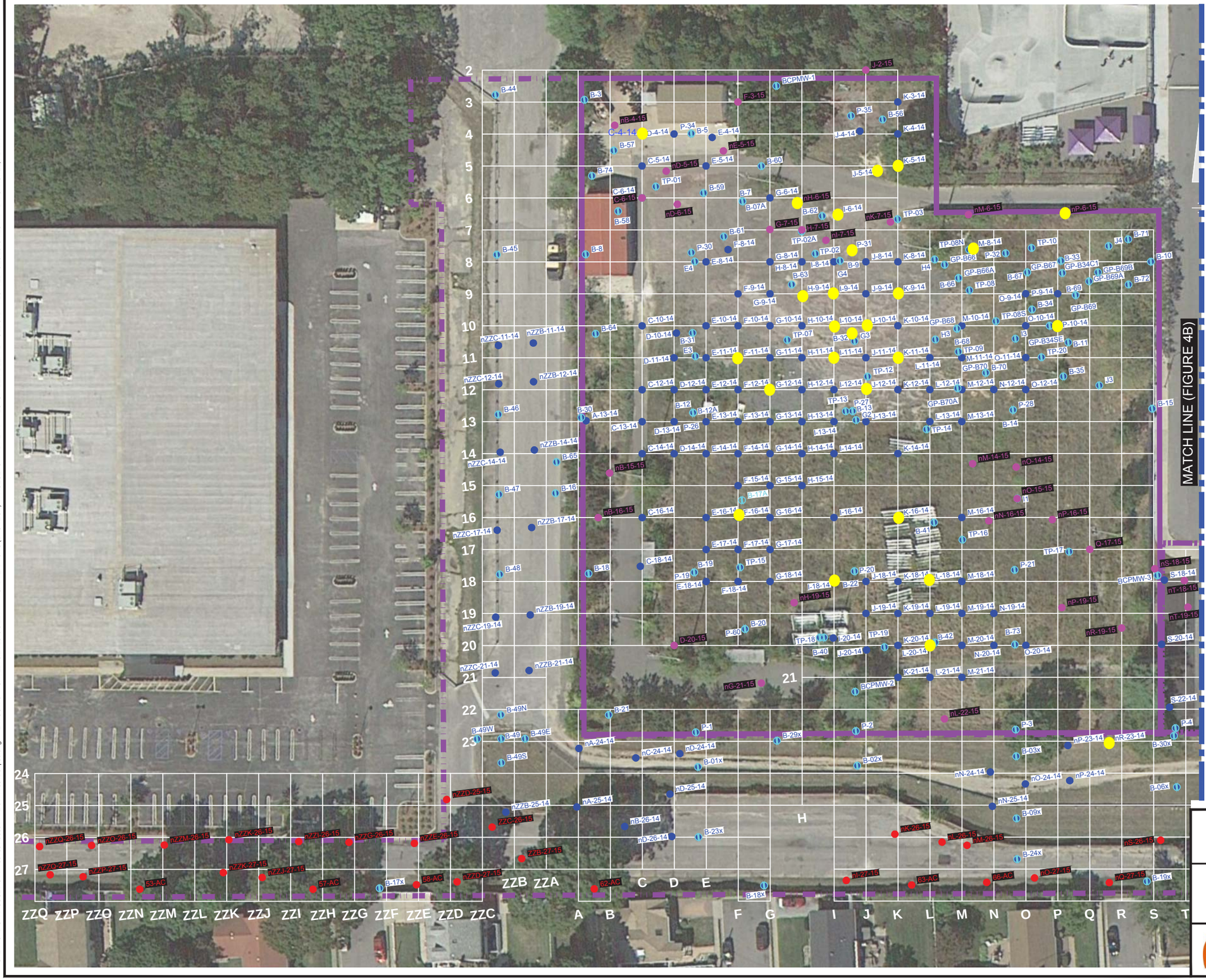
ARCADIS Design & Consultancy for natural and built assets

15-20 foot Horizon to Define 50 mg/kg	
Boring Location	Sample depth intervals (ft bls)
E-9	16-18, 18-20
H-9	16-18, 18-20
J-9	16-18, 18-20
K-10	16-18, 18-20
B-11	16-18, 18-20
B-12	16-18, 18-20
D-16	16-18, 18-20
J-14	16-18, 18-20
I-16	16-18, 18-20
H-17	16-18, 18-20
E-21	16-18, 18-20
G-22	16-18, 18-20
H-21	16-18, 18-20
L-21	16-18, 18-20
L-12	16-18, 18-20
K-20	16-18, 18-20
N-20	16-18, 18-20
L-20-14	16-18, 18-20
E-3	16-18, 18-20

20-25 foot Horizon to Define 50 mg/kg	
Boring Location	Sample depth intervals (ft bls)
E-9	20-22, 22-24, 24-26
H-9	20-22, 22-24, 24-26
B-11	20-22, 22-24, 24-26
B-12	20-22, 22-24, 24-26
E-14	20-22, 22-24, 24-26
J-14	20-22, 22-24, 24-26
D-16	20-22, 22-24, 24-26
E-16	20-22, 22-24, 24-26
I-16	20-22, 22-24, 24-26
H-17	20-22, 22-24, 24-26
E-12	24-26
G-11	24-26
E-10	24-26
F-10	24-26

Boring Location	Sample depth intervals (ft bls)
F-10	26-28, 28-30
H-9	26-28, 28-30
E-9	26-28, 28-30
B-11	26-28, 28-30
D-16	26-28, 28-30
E-16	26-28, 28-30
J-14	26-28, 28-30
H-17	26-28, 28-30
I-16	26-28, 28-30
H-15	26-28, 28-30
B-12	26-28, 28-30
E-12	26-28, 28-30
G-11	26-28, 28-30
E-10	26-28, 28-30

Define 500 mg/kg Regardless of Depth	
Boring Location	Sample depth intervals (ft bls)
nl-7	2-4, 4-6, 6-8, 8-10
E-12	2-4, 4-6, 6-8, 8-10
nK-10	2-4, 4-6, 6-8, 8-10
nG-12	2-4, 4-6, 6-8, 8-10
I-9	10-12, 12-14, 14-16, 16-18, 18-20



LEGEND:

- HISTORICAL PCB SAMPLE LOCATION
- PHASE 1 PCB SAMPLE LOCATION
- PHASE 2 PCB STEP OUT SAMPLE LOCATION
- ACCESS ROAD PCB STEP OUT SAMPLE LOCATION

AREA LIMITS

- PARK - BALL FIELD
- EASTERN PORTION OF PARK
- ACCESS ROAD
- PROPOSED TREATABILTY STUDY SAMPLE LOCATION SEE TABLE 1 FOR DETAILS

SOURCE:
SITE AERIAL PHOTOGRAPH ADOPTED FROM GOOGLE EARTH PRO WITH AN IMAGERY DATE OF 06/19/2014.

0 60' 120'

APPROXIMATE SCALE IN FEET

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK

BETHPAGE COMMUNITY PARK PROPOSED TREATABILTY STUDY SAMPLE LOCATIONS

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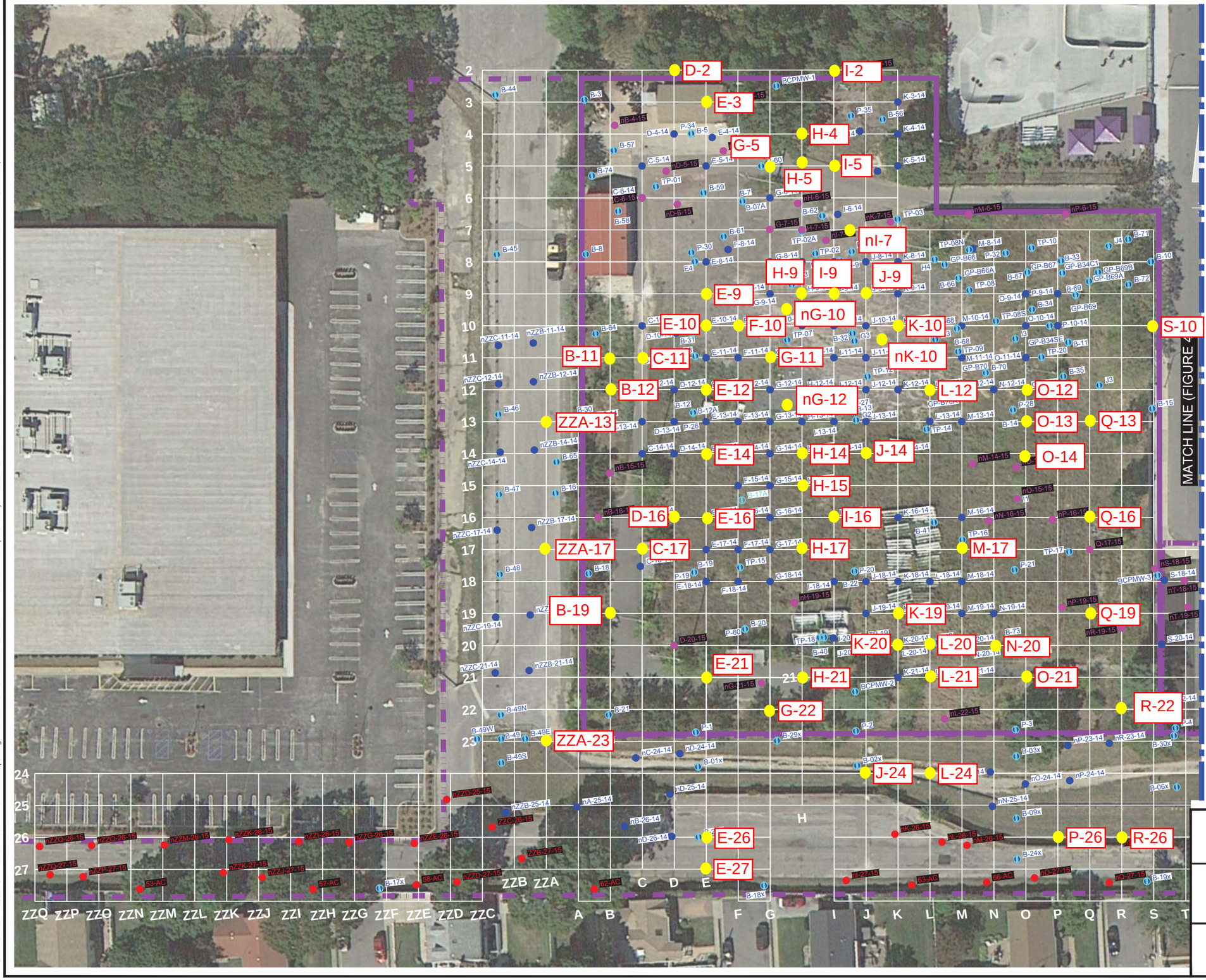
FIGURE 1



LEGEND:

- HISTORICAL PCB SAMPLE LOCATION
- PHASE 1 PCB SAMPLE LOCATION
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- ACCESS ROAD PCB STEP OUT SAMPLE LOCATION

AREA LIMITS

- PARK - BALL FIELD
- EASTERN PORTION OF PARK
- ACCESS ROAD
- PROPOSED DELINEATION SAMPLE LOCATION

SOURCE:
SITE AERIAL PHOTOGRAPH ADOPTED FROM GOOGLE EARTH PRO WITH AN IMAGERY DATE OF 06/19/2014.

0 60' 120'

APPROXIMATE SCALE IN FEET

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK

BETHPAGE COMMUNITY PARK PROPOSED DELINEATION SAMPLE LOCATIONS

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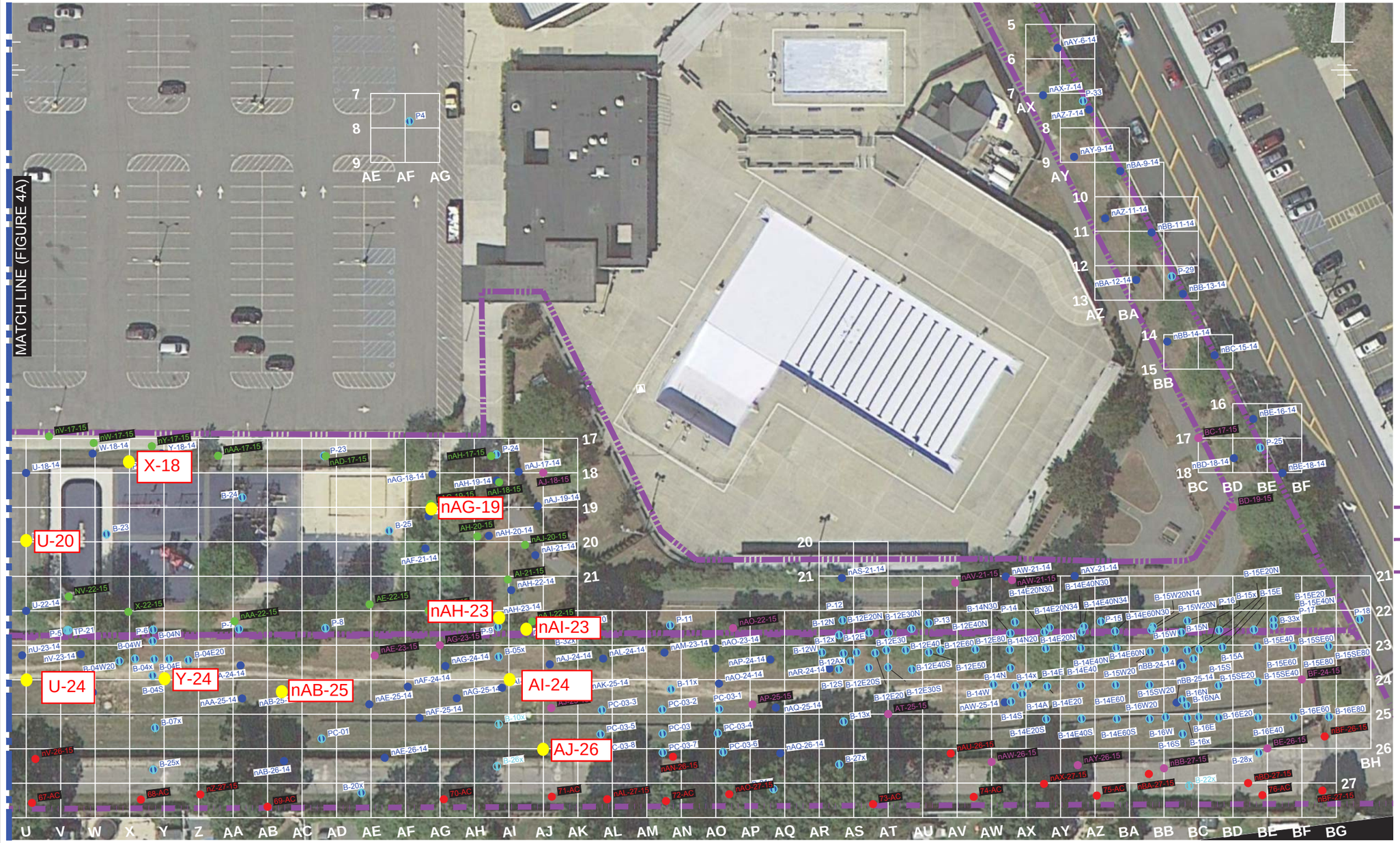
FIGURE 2



SOURCE:
SITE AERIAL PHOTOGRAPH ADOPTED FROM GOOGLE EARTH PRO WITH AN IMAGERY DATE OF 06/19/2014.

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK

BETHPAGE COMMUNITY PARK PROPOSED DELINEATION SAMPLE LOCATIONS

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FIGURE 3

CITY:SYRACUSE-NY DIV/GROUP:ENV DB:A.SANCHEZ LD:ALS PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*OFF=*REF*
G:\ENVCAD\SYRACUSE\ACTIVE\NY001051\0000\PAKB6\NY1051B01pcb.dwg LAYOUT: 3B SAVED: 8/24/2015 3:24 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: PDF LTRP PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 9/29/2015 1:28 PM BY: SANCHEZ, ADRIAN